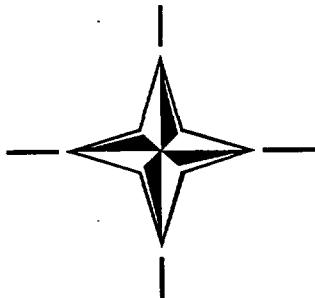


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STANAG 4458
(Edition 1)

**NORTH ATLANTIC TREATY ORGANIZATION
(NATO)**



**MILITARY AGENCY FOR STANDARDIZATION
(MAS)**

**STANDARDIZATION AGREEMENT
(STANAG)**

SUBJECT: 105MM AMMUNITION FOR RIFLED TANK GUNS

Promulgated on 25 March 1998

~~A. GRØNHEIM~~
Major-General, NOAF
Chairman, MAS

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(Edition 1)

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RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardisation Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.

2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is the "Declaration by which a nation formally accepts the content of this Standardization Agreement".

5. Implementation is "The fulfilment by a nation of its obligations under this Standardization Agreement".

6. Reservation is "The stated qualification by a nation which describes that part of this Standardization Agreement which it cannot implement or can implement only with limitations".

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page (iii) gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page (iv) (and subsequent) gives details of reservations and proprietary rights that have been stated.

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N A T O U N C L A S S I F I E D

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RATIFICATION AND IMPLEMENTATION DETAIL
STADE DE RATIFICATION ET DE MISE EN APPLICATION

Nation		National Implementing Document national de mise en application	Implementation/Mise en application					
			Forecast Date prévue			Actual Date Date réelle		
			NAVY MER	ARMY TERRE	AIR	NAVY MER	ARMY TERRE	AIR
BE	GSA 98/17708 of/du 13.02.98	This STANAG						03/98
CA	MWA:2441-4458 (DLR3-4) of/du 12.12.95	This STANAG						12/95
DA	MA204.69-S4458/MAM3-20820 of/du 22.10.96	This STANAG						01/97
FR	1264 DEF/EMAT/ETUDES/20 of/du 20.05.97							05/97
GE	BMVg-FÜSIV2-Az03-51-60	This STANAG		05/98				
GR	FN.069.1/8/116612/DN.103/HAGS/DPPD/3 of/du 29.01.96							01/97
IT	ARM/NATO/NU/371 of/du 20.02.98	This STANAG		01/98				
LU	BO 5943/95 of/du 04.10.95		WILL NOT IMPLEMENT/ NE MET PAS EN APPLICATION					
NL	NR M96000611 of/du 09.01.96		WILL NOT IMPLEMENT/ NE MET PAS EN APPLICATION					
NO	MAS-1092/96/FO/HST/JG/ST4458 of/du 02.12.96	This STANAG						01/97
PO								
SP	OMD No 323/11991/97 BOD No 195 (07-10-97) of/du 30.10.97							01/98
TU	TUDEL-97/260 of/du 20.01.97			12/99				
UK	D/DSTAN/341/8/4458 of/du 06.09.95							01/98
US	SAUS-IA-IPP of/du 26.05.97							01/98

* See overleaf reservations/Voir réserve au verso

+ See comments overleaf/Voir commentaires au verso

x Service(s) implementing/Armée(s) mettant en application

Releasable to NACC/PFP Non releasable

Peut être communiqué au CCNA/PPP Ne peut être communiqué

O T A N S A N S C L A S S I F I C A T I O N

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NATO STANDARDIZATION AGREEMENT
(STANAG)

105MM AMMUNITION FOR RIFLED TANK GUNS

- ANNEXES:
- A - Principles.
 - B - Required Features for a 105-mm Rifled Tank Gun.
 - C - General Interfaces and Characteristics for ammunition to be fired from 105-mm rifled tank guns, and stored in certain areas in the tank provided for that purpose.
 - D - Specific Gun/Ammunition Matrices of 105 mm Weapon Systems
 - Part 1: Gun Parameters
 - Part 2: Ammunition in National Inventories
 - Part 3: Ammunition and Parameters of Manufacturing Nations
 - Part 4: Ammunition Listed by Natures

Related Documents:

- STANAG 2895 Extreme climatic conditions and derived conditions for use in defining design/test criteria for NATO forces materiel.
- STANAG 4370 Environmental testing.
- STANAG 4110 Definition of pressure terms and their interrelationship for use in the design and proof of cannons and ammunition.
- STANAG 4123 Determination of the classification of military ammunition and explosives.
- STANAG 4170 Principles and methodology for the qualification of explosive materials for military use.

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STANAG 4235	Electrostatic environmental conditions affecting the design of materiel for use by NATO forces.
STANAG 4236	Lightning environmental conditions affecting the design of materiel for use by NATO forces.
AOP-2	The identification of ammunition
AOP-7	Manual of tests for the qualification of explosive materials for military use.

AIM

1. The aim of this agreement is to ensure interchangeability of 105 mm ammunition for use in NATO 105 mm rifled tank guns.

AGREEMENT

2. Participating Nations agree that, subject to their operational requirements, when a new 105 mm rifled tank gun is introduced, it will also be able to fire the ammunition listed in this STANAG.

DETAILS OF THE AGREEMENT

3. Participating Nations agree to the Principles (Annex A), the Required Features for a 105 mm Rifled Tank Gun (Annex B), and Interfaces and Characteristics for Ammunition (Annex C) as specified in this STANAG.

4. Any assessment of interchangeability must be based on officially conducted tests. Eligible ammunition will be listed in Annex D of this STANAG, which may be revised as appropriate by AC/225-Land Group 2 or another body nominated by that group. Such changes, which must be approved by AC/225-Land Group 2 in plenary session, may be made without resubmitting this STANAG for ratification. Changes will be issued as amendments to this STANAG.

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5. Ratifying Nations agree that, when consistent with national laws and policies, they will make available to other ratifying Nations the results of any tests conducted with the subject ammunition in accordance with the STANAG. The focal point for this exchange of information will be AC/225 Land Group 2. Ratifying Nations further agree to:

- (a) Make nationally produced ammunition available, when consistent with national laws and policies, to other ratifying Nations to conduct their own tests, subject to appropriate contractual agreement.
- (b) Confirm in writing to AC/225 Land Group 2 the compatibility of candidate ammunition with their own weapons.
- (c) Attempt to resolve any existing disagreement by submitting this to an ad hoc group formed for this purpose by AC/225 Land Group 2.

IMPLEMENTATION OF THE AGREEMENT

6. This STANAG is implemented when a Nation has issued the necessary orders putting the provisions of this STANAG into effect.

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ANNEX A to
STANAG 4458
(Edition 1)

PRINCIPLES

1. This STANAG covers:
 - 105 mm service ammunition for rifled tank guns;
 - 105 mm training ammunition for rifled tank guns.
2. The required technical characteristics of the weapons used to confirm or validate the requirements of this STANAG ("Test Weapons") are listed in Annex B. Test weapons may be proposed by ratifying Nations.
3. The ammunition shall comply with the general interfaces and characteristics as described in Annex C.
4. Compliance with the above requirements shall be confirmed or validated by official test results in accordance with the provisions made in paragraphs 3 to 5 of the STANAG.
5. The ratifying Nations sponsoring developed test weapons will make every effort to loan such weapons to other requesting Nations for test purposes. Loan of such equipment will be made under established NATO provisions and procedures/policies already in existence and in accordance with MAS requirements.
6. Nations ratifying this STANAG shall mark all qualified ammunition and packages containing standardized ammunition in accordance with AOP-2.
7. Stockpiles (stores) of such standardized ammunition of ratifying Nations must be regularly inspected, normally during a periodic inspection by the Nation concerned. Such an inspection will be in accordance with nationally approved surveillance methods. Ammunition lots no longer meeting the performance requirements of this agreement shall be deemed unsuitable for NATO use.
8. The ratifying Nations agree to furnish on request (under NATO security agreements) to the other ratifying Nations the available data on safety including toxicity and performance (accuracy, perforation characteristics against NATO targets, lethal area, incendiary capacity, etc.) of standardized ammunition developed for their forces.

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ANNEX B to
STANAG 4458
(Edition 1)

REQUIRED FEATURES FOR A 105 mm RIFLED TANK GUN

1. Calibre 105 + 0.05mm
- 0.00mm
2. Chamber See Drawing below.
3. Maximum pressure compatible with barrel elastic limit over its entire length The applicable Cannon Safe Maximum Pressure (SMP) curve for the tube being fired. The curve is pressure versus distance (relating to the barrel assembly) which specifies, as a result of design, the particular value of pressure load along the barrel which, if exceeded, could result in the occurrence of permanent deformation.
4. Firing Signal The electrical firing signal at the firing pin must be > 6 V and > 2.1 A., for a minimum of 4 ms.
5. Rifling The tube must have either a right hand twist of 1 turn in 18 calibres, having 28 grooves and a rifling depth of 1.15mm (groove diameter 107.3mm), or (as with the French F1 tube), a right hand twist of 1 turn in 25 calibres, having 32 grooves and a rifling depth of 1.0mm (groove diameter 107.00mm).
6. Wear Criteria In accordance with National Procedures.
7. Breech Mechanism Each country should review the fatigue limits to which the breech mechanism installed in its tanks was tested to ensure that the weapon is capable of firing high pressure rounds listed in Annex D.
8. Cannon Pressure Each country should proof their cannons, as a minimum, at the pressure of whichever round, listed in Annex D, which generates the highest pressure not exceeding the system maximum pressure. This will assure the capability of safely firing all rounds listed in Annex D which are compatible with the cannon.

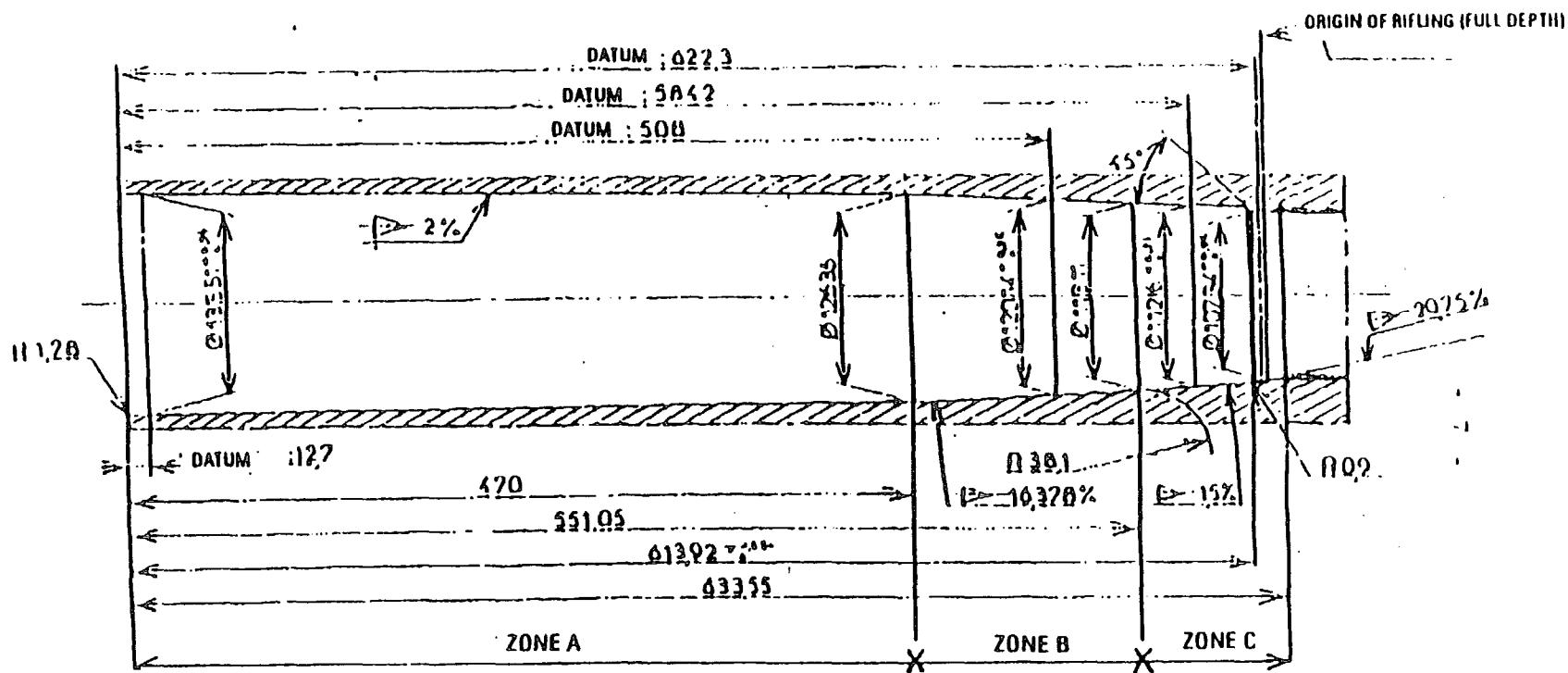
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ANNEX B to
STANAG 4458
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STANDARDISED 105MM TANK GUN CHAMBER



NOTES:

1. The length of zone A plus zone B in the M68/M68A1 gun is 553.11 mm (551.05 in this drawing).
2. The difference in the length of zone B in different guns produced different diametral tapers at the end of zone C as under:
 - F1/L7 gun I: 66.7 or 1.5%
 - M68 gun I : 100 or 1%

FIGURE B-1

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N A T O

U N C L A S S I F I E D

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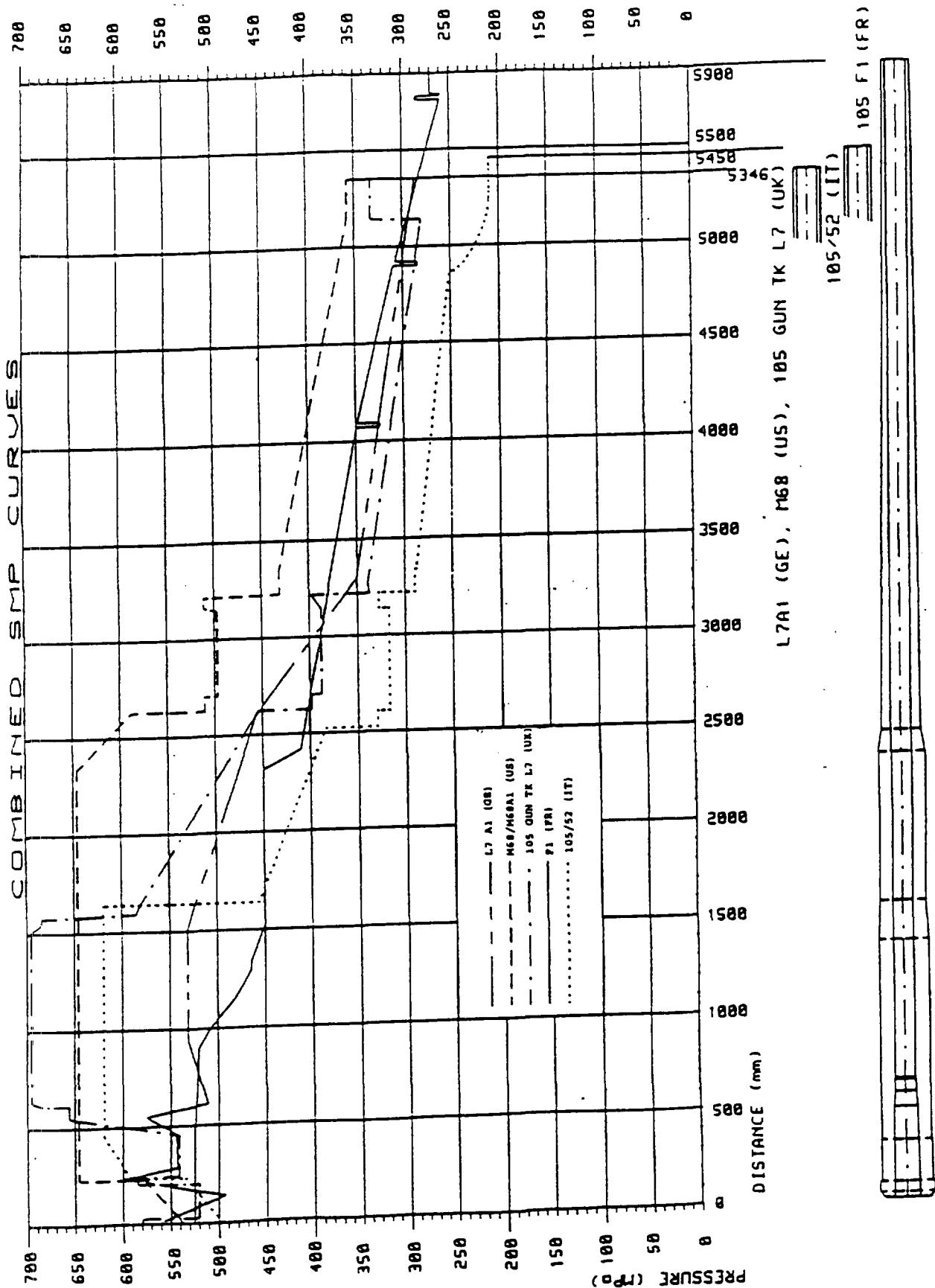


FIGURE B.2

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ANNEX B to
STANAG 4458
(Edition 1)

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TABLE OF TUBE LENGTH VS MAXIMUM PRESSURE

Position from the Breech Face (mm)	Pressure (MPa)				
	FR	GE	IT	UK	US
0	525		497.5	580	536.8
10		558.2			
25				580	
25				520	
44					544.6
45					545.4
132		493.8			
200				520	
200				585	
216					576.1
220					574.1
226					576.5
226					646.2
226.8			535.4		
226.8			591.6		
233		598.6			
241				585	
241				541	
290		543.8			
320	525				
468			620.5		
469.9				541	
470	525	544.9			
551		576.3			
551.05				656.85	
611.92				656.85	
614		510.7			
615.44				685.74	
631.55				696.79	
635				696.79	
900	520				
947		530.8			
1000	508				
1150	482				
1250	465				
-----	444				

Position from the Breech Face (mm)	Pressure (MPa)				
	FR	GE	IT	UK	US
1511		530.8			
1511.3				696.79	
1530	450				
1546.86				685.74	
1574.8				685.74	
1589				585.07	
1635		620.5			
1635		456.5			
1636				581.81	
2320	450				
2338					646.2
2420	410				
2525		384			
2525			329.9		
2600		457			
2602			329.9		
2602			317.2		
2622.55				455.34	
2622.55				398.25	
2623					388.0
2623					510.3
2698.75				398.24	
2700					511.4
2702.13				388.42	
2703					497.8
2848.17				383.41	
3086				383.41	
3142					497.8
3142.18				388.41	
3145.79				398.26	
3146					511.4
3149		317.2			
3149			328.9		
3212					511.4
3215					497.8
3218.38				398.26	
3221.99				388.12	
					431.0

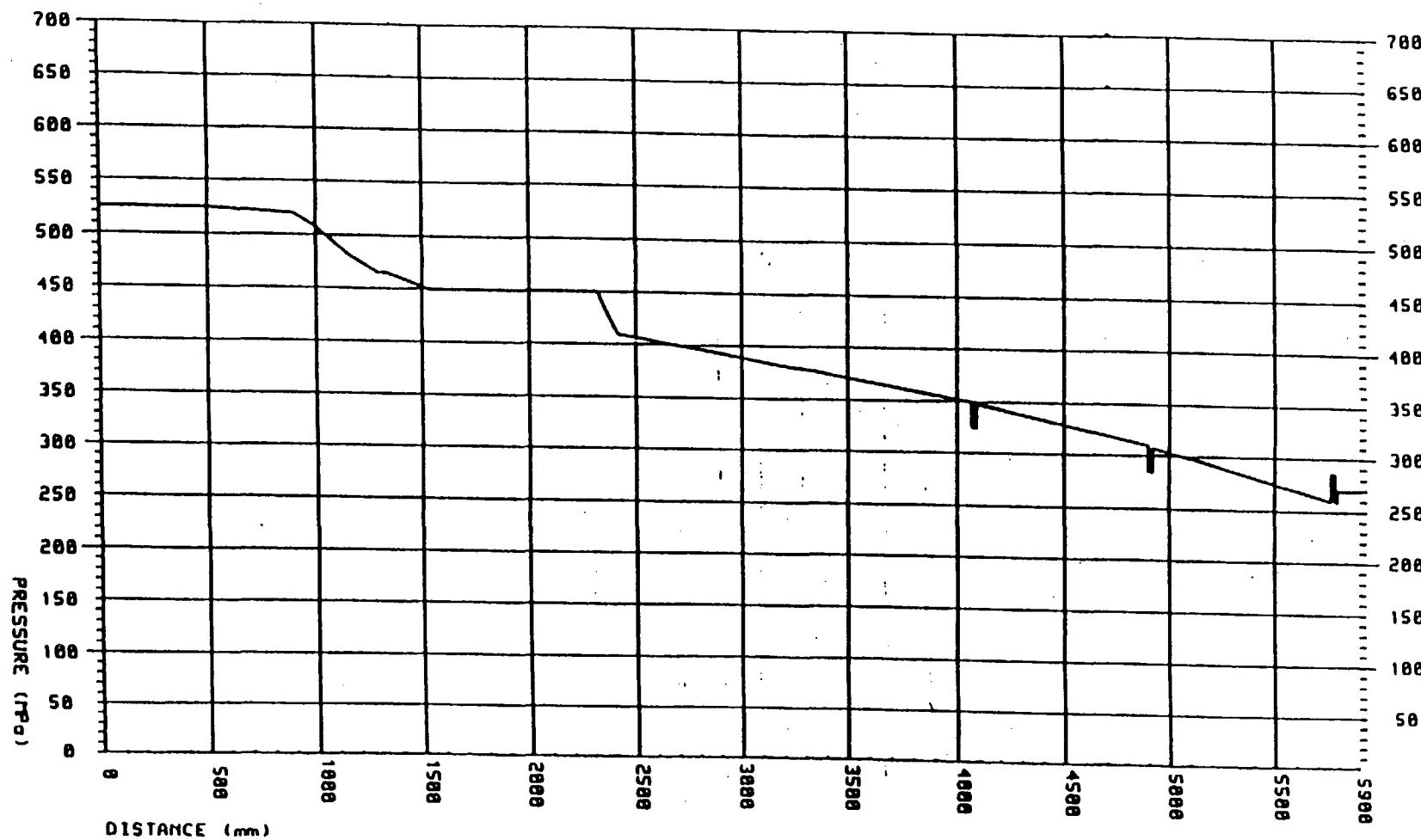
Position from the Breech Face (mm)	Pressure (MPa)				
	FR	GE	IT	UK	US
3225			128.9		
3225			190.3		
3225.8				139.19	
3225.8				138.12	
3250	380				
3250	355				
3270	355				
3270	380				
3272.79				138.12	
3272.79				139.19	
3303		351.2			
3335			290.3		
3335			289.6		
3346					431.0
4070	350				
4070	325				
4090	325				
4090	348				
4850			251.7		
4900	310				
4900	285				
4920	285				
4920	308				
5115		293.7			
5118.1				281.83	
5142					358.1
5142.23				281.05	
5142.23				333.45	
5346				333.45	358.1
5450			210		
5760	260				
5760	255				
5780	285				
5780	260				
5790	260				
5790	270				
5900	270				

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ANNEX B to
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SMP CURVE FOR GUN F1 (FR)



ANNEX B to
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SMP CURVE DATA FOR GUN F1 (FR)

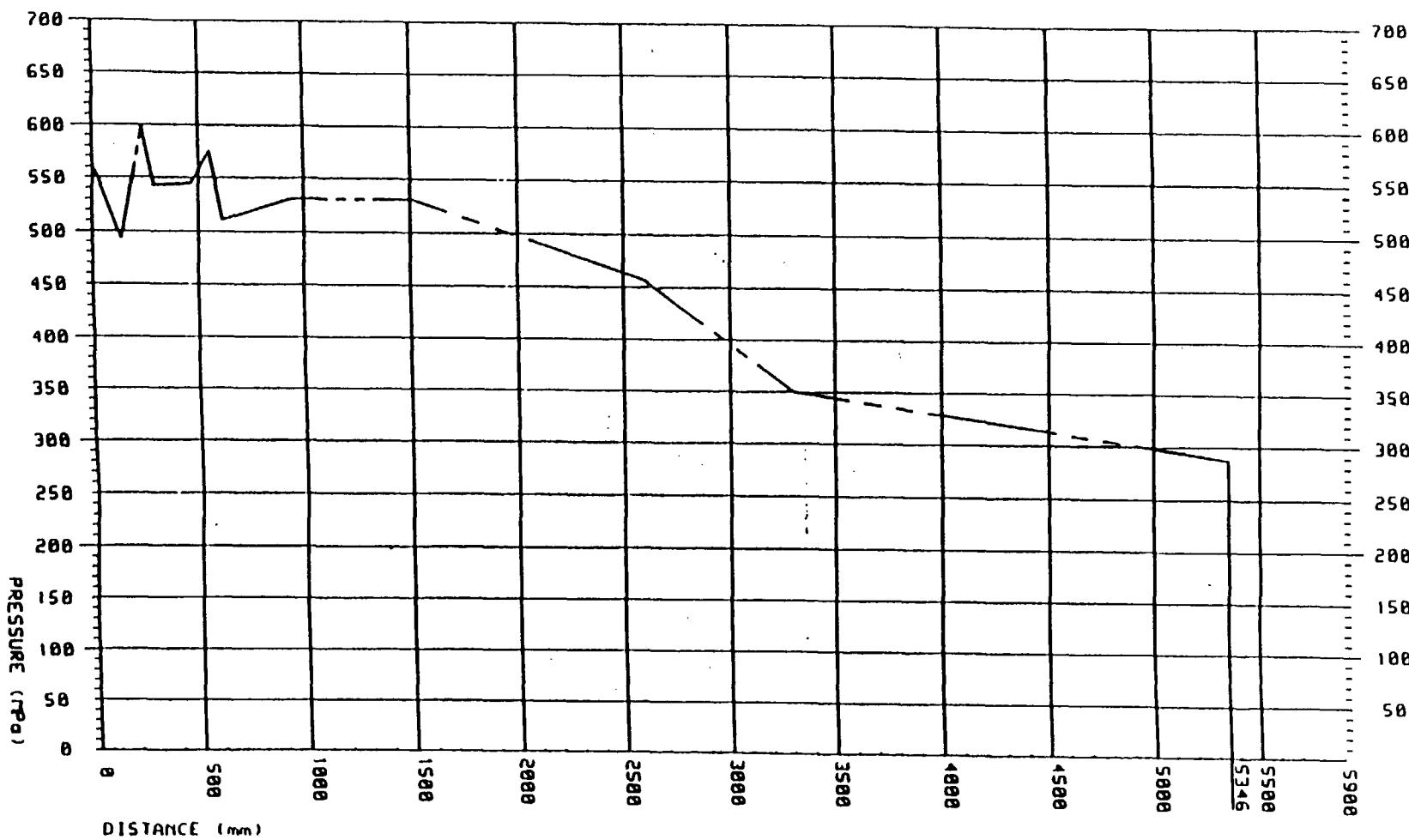
Distance from Breech Face (mm)	Pressure (MPa)
0	525
320	525
470	525
900	520
1000	508
1150	482
1290	465
1330	465
1530	450
2320	450
2420	410
3250	380
3250	355
3270	355
3270	380
4070	350
4070	325
4090	325
4090	348
4900	310
4900	285
4920	285
4920	308
5760	260
5760	285
5780	285
5780	260
5790	260
5790	270
5900	270

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SMP CURVE FOR GUN L7 A1 (GE)



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ANNEX B to
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SMP CURVE DATA FOR GUN L7A1 (GE)

Distance from Breech Face (mm)	Pressure (MPa)
10	558.2
132	493.8
233	598.6
290	543.8
470	544.9
551	576.3
614	510.7
947	530.8
1511	530.8
2600	457
3303	351.2
5115	293.7

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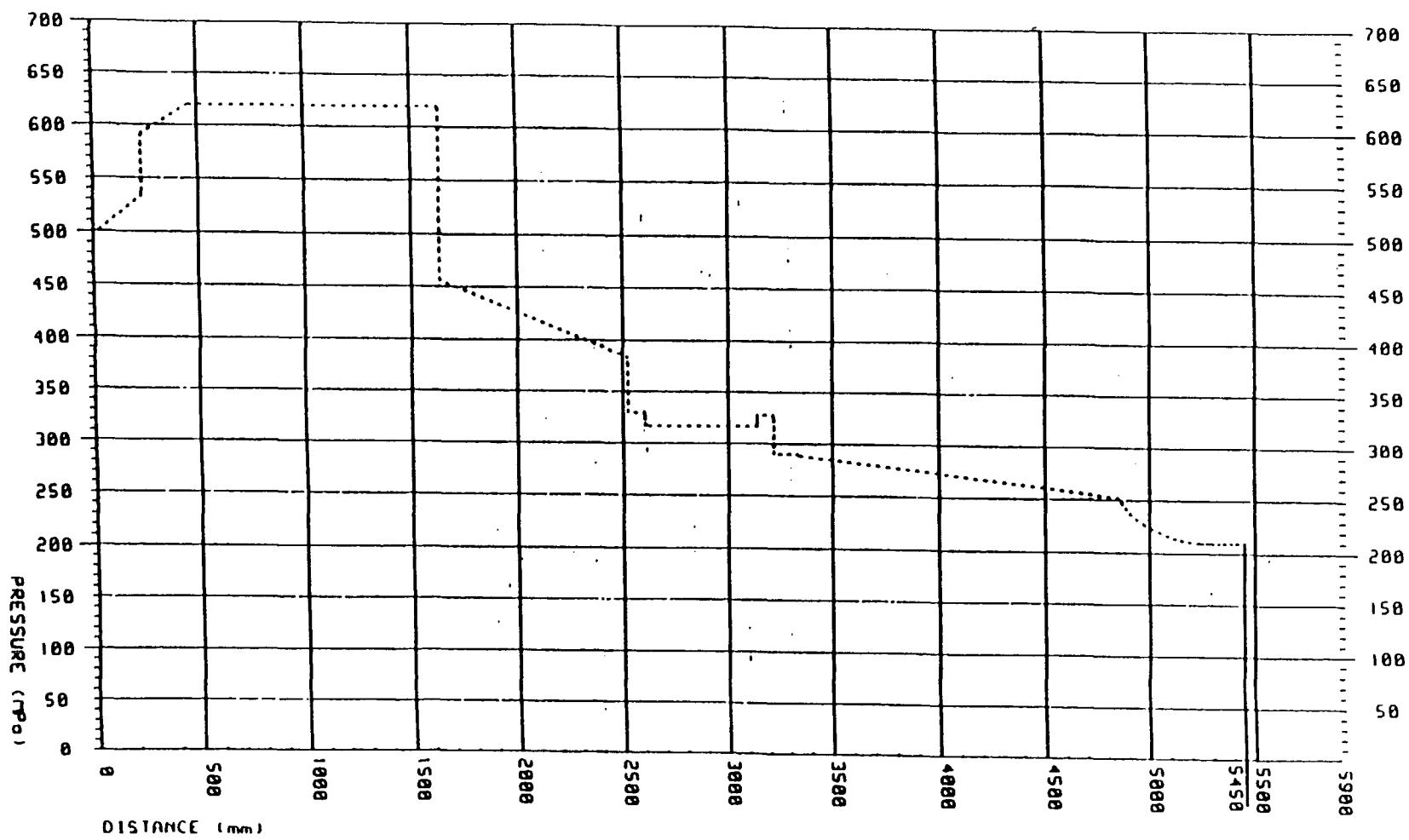
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SMP CURVE FOR GUN 105/52 (IT)



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SMP CURVE DATA FOR GUN 105/52 (IT)

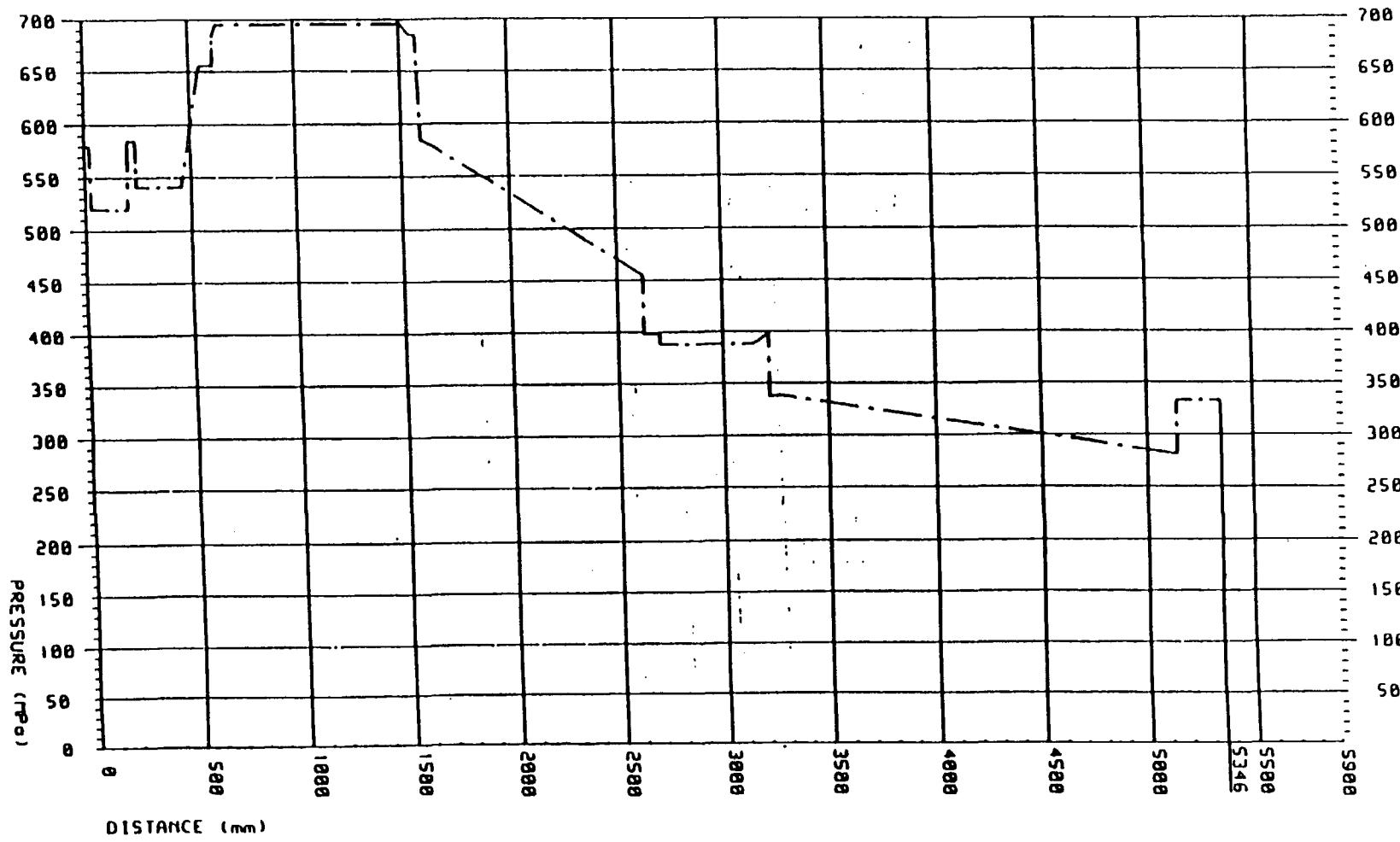
Distance from Breech Face (mm)	Pressure (MPa)
00.0	497.5
226.8	535.4
226.8	591.6
468.0	620.5
1635.0	620.5
1635.0	456.5
2525.0	384.0
2525.0	329.9
2602.0	329.9
2602.0	317.2
3149.0	317.2
3149.0	328.9
3225.0	328.9
3225.0	290.3
3335.0	290.3
3335.0	289.6
4850.0	251.7
5450.0	210.0

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SMP CURVE FOR GUN TK L7 (UK)



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SMP CURVE DATA FOR GUN TK L7 (UK)

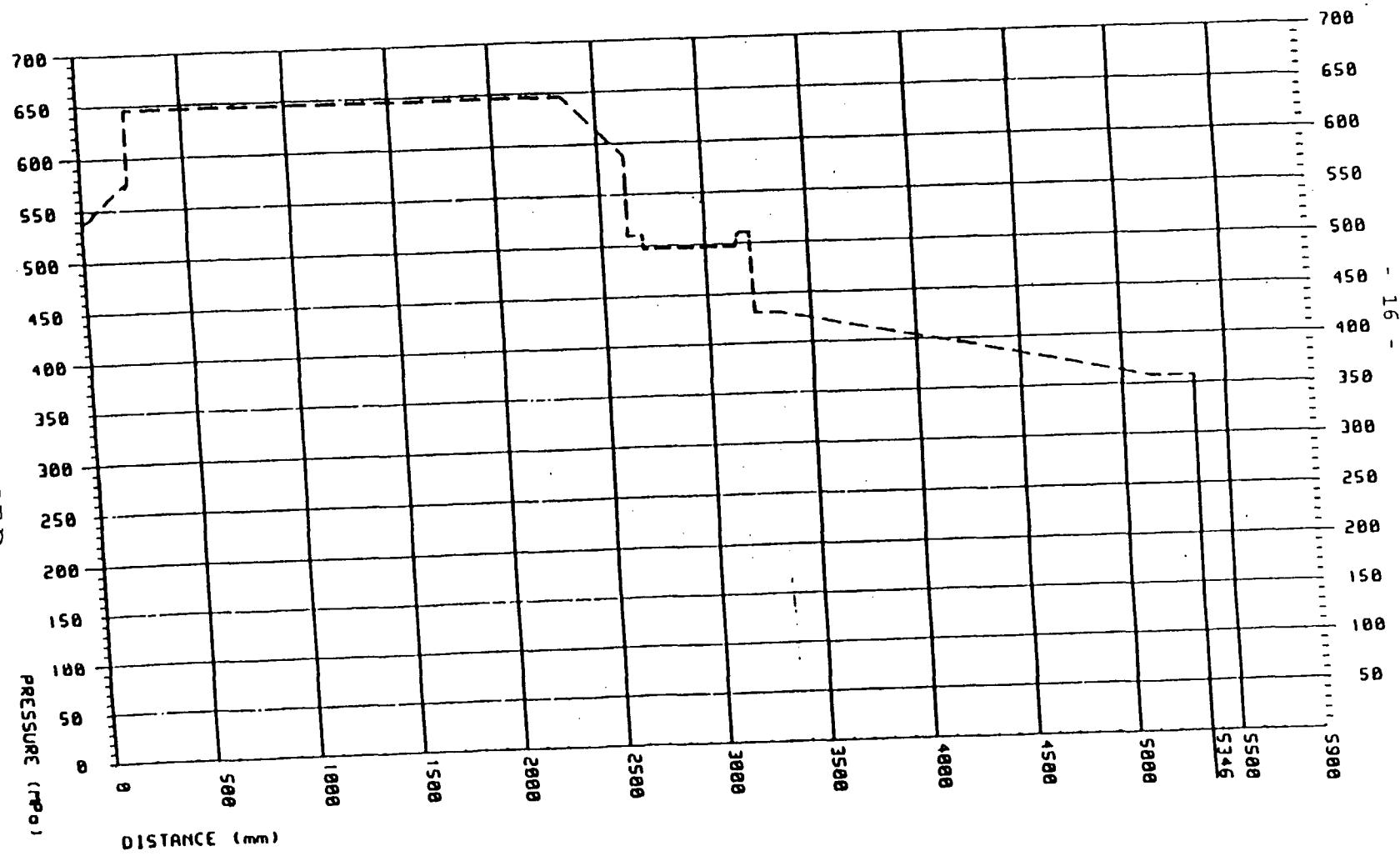
Distance from Breech Face (mm)	Pressure (MPa)
0	580
25	580
25	520
200	520
200	585
241	585
241	541
469.9	541
551.05	656.85
613.92	656.85
615.44	685.74
633.55	696.79
635	696.79
1511.3	696.79
1546.86	685.74
1574.8	685.74
1589	585.07
1636	581.81
2622.55	455.34
2622.55	398.25
2698.75	398.24
2702.33	388.42
2868.17	388.41
3086	388.41
3142.18	388.41
3145.79	398.26
3218.38	398.26
3221.99	338.12
3225.8	339.19
3225.8	338.12
3272.79	338.12
3272.79	339.19
5118.1	281.83
5142.23	281.05
5142.23	333.45
	333.45

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SMP CURVE FOR GUN M68 (US)



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STANAG 4458
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SMP CURVE DATA FOR GUN M-68/M68A1 (US)

Distance from Breech Face (mm)	Pressure (MPa)
0	536.8
44	544.6
45	545.4
210	576.1
210	574.1
226	576.5
226	646.2
2338	646.2
2623	588.0
2623	510.3
2700	511.4
2703	497.8
3142	497.8
3146	511.4
3212	511.4
3215	497.8
3222	431.0
3346	431.0
5142	358.1
5346	358.1

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ANNEX C to
STANAG 4458
(Edition 1)

GENERAL INTERFACES AND CHARACTERISTICS FOR AMMUNITION TO BE FIRED
FROM 105 mm RIFLED TANK GUNS AND STORED IN CERTAIN
AREAS IN THE TANK PROVIDED FOR THAT PURPOSE

<u>Parameters</u>	<u>Values/Characteristics</u>
1. Dimensions (min/max) of the cartridge	See Ammunition envelope drawing below.
2. Maximum pressure of ammunition compatible with barrel elastic limit over its entire length	Within the temperature range declared in Annex D, the pressure generated by a round must be less than the applicable Cannon Safe Maximum Pressure for the tube from which it is to be fired.
3.a Primer Functioning	The primer must function when the firing signal is >6 V and > 2.1 A, for a minimum of 4ms.
3.b Primer Insensitivity	Primer must not respond if a current of 0.2 A flows for 18 seconds.
4. Maximum recoil impulse (-40°C to Upper Firing Temperature (UFT))	The maximum recoil impulse which a tank armament system can withstand as well as the maximum impulse generated by a round of ammunition are listed in Annex D. Each country should review the tabulated data prior to firing a foreign round of ammunition from its tank.
5. Toxicity	Validation of acceptable levels of toxicity should be conducted by developing nations in their appropriate tank systems, with results subsequently declared to other nations.
6. Safe obturation	Must be assured under all working conditions of gun and ammunition.

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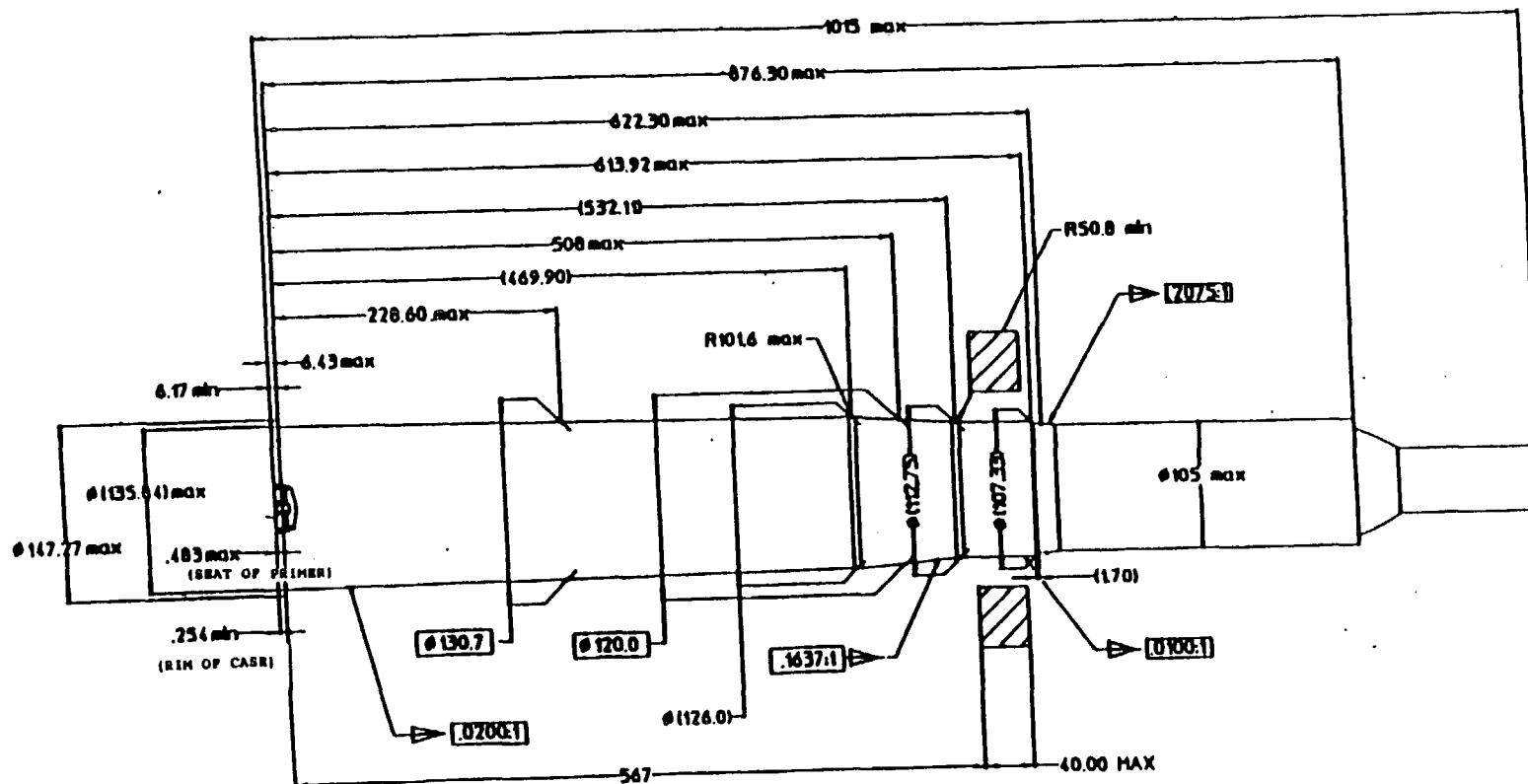
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<u>Parameters</u>	<u>Values/Characteristics</u>
7. Tank Storage, Grip Areas	The ammunition must be capable of being stored in certain areas of the tank provided for that purpose and utilizing ammunition support, or grip areas, as illustrated on the Ammunition Envelope drawing, see next page.
8. Cook-off temperature	150°C Minimum
9. Electromagnetic/electro-	In accordance with STANAGs 4234, static compatibility 4235 and 4236
10. Safety and effect of environmental influences	National Test Procedures

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AMMUNITION ENVELOPE AND RECOMMENDED GRIP AREAS



NOTE: RECOMMENDED GRIP AREAS

FIGURE C.1

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ANNEX D to
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(Edition 1)

PART 1 - GUN PARAMETERS

Gun	Tank	Country of origin	Max. acceptable recoil impulse	Tube Length	Remarks
<u>BELGIUM</u>					
L7A4	LEOPARD 1A5 (BE)	GE	18,000 N-SEC	5346 MM	
<u>CANADA</u>					
L7A3	LEOPARD C1	GE	18,000 N-SEC	5346 MM	280 MM Recoil Length
M68	LEOPARD C1	US	18,000 N-SEC	5346 MM	
<u>DENMARK</u>					
L7A1 L7A3	CENTURION LEOPARD 1A5	UK GE	18,000 N-SEC 18,000 N-SEC	5346 MM 5346 MM	280 MM Recoil Length
<u>FRANCE</u>					
F1	AMX 30B/AMX30 B2	FR	21,845 N-SEC	5900 MM	See note 3
<u>GERMANY</u>					
L7A3	LEOPARD 1A5	GE	18,000 N-SEC	5346 MM	280 MM Recoil Length
<u>GREECE</u>					
L7	LEOPARD 1GR LEO 1V LEO 1GR 2	GE GE GE	18,000 N-SEC 18,000 N-SEC 18,000 N-SEC	5346 MM 5346 MM 5346 MM	
M68	M48A5 M60A1 M60A3	US US US	22,250 N-SEC 22,250 N-SEC 22,250 N-SEC	5346 MM 5346 MM 5346 MM	
<u>ITALY</u>					
L7/L7A1 M68 105/52	LEOPARD 1 M60A1 CENTAURO	GE US IT	18,000 N-SEC 22,250 N-SEC 18,500 N-SEC	5346 MM 5346 MM 5450 MM	

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ANNEX D to
STANAG 4458
(Edition 1)

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Gun	Tank	Country of origin	Max. acceptable recoil impulse	Tube Length	Remarks
NORWAY					
L7A1/A3	LEOPARD 1A1 NO	GE	18,000 N-SEC	5346 MM	280 MM recoil length
L7A1/A3	LEOPARD 1A5 NO	GE	18,000 N-SEC	5346 MM	280 MM recoil length
L7A1/A3	LEOPARD 1A5 NO 2	GE	18,000 N-SEC	5346 MM	280 MM recoil length
PORTUGAL					
M68	M48A5,M60A3	US	22,250 N-SEC	5346 MM	
SPAIN					
F1 M68	AMX-30 EM2 M48A5 E2, M60A1, M60A3	FR US	21,845 N-SEC 22,250 N-SEC	5900 MM 5346 MM	See note 3
UNITED STATES					
M68	M48A5, M60, M60A1, M60A3	US US	22,250 N-SEC	5346 MM	See notes 1 & 2
M68A1 XM35	M1 XM8	US US	24,475 N-SEC 27,812.5 N-SEC	5346 MM 5600 MM	See notes 1 & 2

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ANNEX D to
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(Edition 1)

GUN PARAMETERS

NOTES

Note 1: The M68/M68A1 cannon has a safe maximum pressure of 641 MPa as a result of the manufacturing process and yield strength of the tube and breech ring forgings.

Note 2: The M68A1 breech mechanism has a fatigue life of 5000 equivalent full charge (EFC) rounds. The EFC was developed by proofing the M68 breech with the M735 fired at an extreme service condition pressure of 497 MPa. The M68A1 breech has been qualified to fire rounds which generate pressures in excess of 500 MPa by fatigue testing.

Note 3: The French gun, F1, is approximately 550 mm longer than either the M68/M68 A1 or L7 gun. The F1 also has a different rifling pattern; a right hand twist of one turn in 25 calibres and has 32 grooves, while the other 105mm guns have 28 grooves and a right hand twist of one turn in 18 calibres. Ammunition fired from the F1 gun will have different performance as compared to firing from either the M68 or the L7 guns.

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ANNEX D to
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PART 2 - AMMUNITION IN NATIONAL INVENTORIES

Round	Type	Country	Primer Type	Remarks
<u>BELGIUM</u>				
DM23A1	APFSDS-T	IS*/GE	DM82A2	
DM33	APFSDS-T	IS*/GE	DM102A2	
L52A2	APDS-T	UK	L1A4	
M393A2	HEP-T	US/BE	M86	
M416	SMOKE WP-T	US/BE	M86	
L52A2B1	APDS-T	UK	L1A4	
L39A2	SMOKE-HC	UK	?	
M724A1	TPDS-T	US/BE	M80A1	
<u>CANADA</u>				
M111	APFSDS-T	IS*	L1A4	
DM23A1	APFSDS-T	IS*/GE	DM32A1	
C76	APFSDS-T	CA	C18	
C71	TP/FSDS-T	CA	C16	
C74	TPDS-T	CA	C16	
C72	SH/P-T	CA	C15A2	
C109	SH/P-T	CA	C15A2	
L35A2	HESH-T	UK	L1A4	
L32A3	HESH-T	UK	L1A4	
M416	WP	US	M86	
<u>DENMARK</u>				
L28A1	APDS-T	UK	L1A4) Out of stocks from
L28A1B1	APDS-T	UK	L1A4) end-1995
L52A2	APDS-T	UK	L1A4)
M/80(DM23)	APFSDS-T	IS*/GE	DM82	
M/80(DM23A2)	APFSDS-T	IS*/GE	DM102	
M/85(DM33)	APFSDS-T	IS*/GE	DM102A2	
L35A3	HESH-T	UK	L1A4	
M156	HESH-T	IS*	L1A4	
M416	SMOKE-WP	US	M59	
M/87	SMOKE-WP	IS*	L1A4	
C71	TP/FSDS-T	CA	C16	
M/87	SH/P-T	DA	C15A2	

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Round	Type	Country	Primer Type	Remarks
<u>FRANCE</u>				
OCC 105F1	HEAT-T	FR	TPA27X378ELF1	Fired from F1 only
BSCC 105F4	TP-T	FR	TPA27X378ELF1	Fired from F1 only
OE 105F1	HE	FR	TPA27X378ELF1	
OFUM 105F1	SMOKE, WP	FR	TPA27X378ELF1	
OECL 105F1	ILLUM	FR	TPA27X255EL69	
OFL 105F1	APFSDS-T	FR	TPA27X320EL84	
OXT 105F1	TP-T	FR	TPA27X378ELF1	Fired from F1 only
<u>GERMANY</u>				
DM22	HEAT-MP-T	GE	DM72A2	
DM23A1	APFSDS-T	IS*/GE	DM32A1	
DM23A2	APFSDS-T	IS*/GE	DM102	
DM33	APFSDS-T	IS*/GE	DM102A2	
DM68	TP/HEAT-T	GE	DM72A2	
DM128	TP/CSDS-T	GE	DM82A1	

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Round	Type	Country	Primer Type	Remarks
GREECE				
11-152	HESH-T	IS*		
11-156	HEST-T	IS*		
M456A1	HEAT-T	US	M83	
M456A2	HEAT-T	US	M83	
L35A2	HESH-T	UK	L1A3	
NR-108	HESH-T	NL	L1A4 (No 24)	
M393A2	HEP-T	US	M86	
11-154	APDS-T	IS*		
DM13B1	APFSDS-T	UK	DM32 (L1A4)	
M151	APFSDS-T	IS*		
M413	APFSDS-T	IS*	M427	
M735	APFSDS-T	US	M120	
DM23	APFSDS-T	IS*	DM28A1	
DM23A1	APFSDS-T	IS*	DM32A1	
DM23A2	APFSDS-T	IS*	DM102 (DM82A1)	
M416	SMOKE WP	US	M86	
L39A2	SMOKE BE	UK	L2A2	
L39A3	SMOKE BE	UK	L2A2 and L2A3	
11-161	TP-T	IS*		
M490	TP-T	US	M83	
M467	TP-T	US	M81	
M724A1	TPDS-T	US	M80A1	
ITALY				
M393A2	HEP-T	US	M86	
M416	WP-T	US	M86	
M456 (series)	HEAT-T	US/IT	M83	
M490	TP-T	US/IT	M83	
DM33	APFSDS-T	IS*/GE	DM102A2	
L28 (series)	APDS	UK	L1A4	
L52 (series)	APDS	UK	L1A4	
L35 (series)	HESH	UK	L1A4	
L37	HESH	UK	L4A1 or A2	Similar to US M392 Authorized use, but not in inventory
L47A1	SH-TP	UK	L1A4	
L38A2	SH-TP	UK	L1A4	

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Round	Type	Country	Primer Type	Remarks
<u>NORWAY</u>				
L35A2	HESH-T	UK	L1A4	
M393A2	HEP-T	US	M86	
M456A1	HEAT-T	US	M83	
M416	SMOKE WP-T	US	M86	
L28A1	APDS-T	UK	L1A4	
OFL105F1	APFSDS-T	FR	TPA27x320EL84	
DM68	HEAT-TP-T	GE	DM72A2	
C71	TP/FSDS-T	CA	C16	
<u>PORTUGAL</u>				
M393A2	HEP-T	US	M86	
M413	APFSDS-T	IS*	M427	
M456A1	HEAT-T	US	M83	
M467	TP-T	US	M86	
M490	TP-T	US	M83	
<u>SPAIN</u>				
M-111	APFSDS-T	IS*	L1A4	
PECA-TC512	APFSDS-T	SP	TPA27X378ELF1	
OCC 105F1	HEAT-T	FR/SP	TPA27X378ELF1	Fired from F1 only
OE 105F1	HE	FR/SP	TPA27X378ELF1	
OFUM 105F1	WP	FR/SP	TPA27X378ELF1	
SCC 105F1	TP-T	FR/SP	TPA27X378ELF1	
M490	TP-T	US/SP	M83	Fired from F1 only
M456A1	HEAT-T	US/SP	M83	

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Round	Type	Country	Primer Type	Remarks
UNITED KINGDOM				
L28	APDS-T	UK	L1A4	
L32A3	HESH-T	UK	L1A4	
L35A3	HESH-T	UK	L1A4	
L35A2	HESH-T	UK	L1A4	
L37	HESH-T	UK	L4A1 or A2	
L38A3	SH-TP-T	UK	L1A4	
L47A1	SH-TP-T	UK	L1A4	
L52	APDS-T	UK	L1A4	
L64A4	APFSDS-T	UK	L20A1	
H6/62	APFSDS-T	UK	L20A1	
L63A2	DS/Prac-T	UK	L1A4	
UNITED STATES				
M392	APDS-T	US	L4A1	
M392A2	APDS-T	US	M80A1	
M393A1	TP-T	US	M86	
M393A1	HEP-T	US	M86	
M393A2	HEP-T	US	M86	
M416	SMOKE, WP-T	US	M86	
M456	HEAT-T	US	M83	
M456A1	HEAT-T	US	M83	
M456A2	HEAT-T-MP	US	M83	
M467	TP-T	US	M86	
M490	TP-T	US	M83	
M490A1	TP-T	US	M80A1	
M494	APERS-T	US	M86	
M724	TPDS-T	US	M80A1	
M724A1	TPDS-T	US	M80A1	
M728	APDS-T	US	M80A1	
M735	APFSDS-T	US	M120	
M774	APFSDS-T	US	M120	
M833	APFSDS-T	US	M120	
M900	APFSDS-T	US	M128	See notes 1, 2 and 3

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AMMUNITION IN NATIONAL INVENTORIES

NOTES

Note 1: The M900 generates extremely high pressures (597 MPa) when fired at the upper firing temperature. This round has an equivalent full charge (EFC) value of 3.

Note 2: The M68A1 cannon, containing the M68A1 breech mechanism is the only US system qualified to fire the M900 round.

Note 3: The M1 tank with a forged M68A1 breech is the only US tank safety certified to fire the M900 round.

* = Originally manufactured in Israël

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PART 3 - AMMUNITION AND PARAMETERS OF MANUFACTURING NATIONS

Round	Type	Country	Safe Max. Pressure	Primer Type	Recoil Impulse	Safety Temp. Range	Maximum Length	Remarks
CANADA								
C76	APFSDS-T	CA	510 MPa	C18		-37C, +52C	927 MM	
C71	TP/FSDS-T	CA	510 MPa	C16		-40C, +52C	785 MM	Safety template less than 8 kms
C74	TPDS-T	CA	510 MPa	C16		-40C, +52C	820 MM	
C72	SH/P-T	CA	510 MPa	C15A2		-40C, +52C	936 MM	
C109	SH/P-T	CA	510 MPa	C15A2		-40C, +52C	936 MM	
M/87	SH/P-T	DK	510 MPa	C15A2	11,200 N-SEC	-46C, +52C	937 MM	
FRANCE								
OCC 105F1	HEAT-T	FR	350 MPa	TPA27X378ELF1	18,500 N-SEC	-31C, +51C	990 MM	See note 4 Fire from F1 only
BSCC 105F4	TP-T	FR	330 MPa	TPA27X378ELF1	18,200 N-SEC	-31C, +51C	990 MM	Fire from F1 only
OE 105F1	HE	FR	260 MPa	TPA27X378ELF1	12,200 N-SEC	-31C, +51C	990 MM	
OFUM 105F1	SMOKE, WP	FR	270 MPa	TPA27X378ELF1	12,800 N-SEC	-31C, +51C	990 MM	
OECL 105F1	ILLUM	FR	72 MPa	TPA27X225EL69	3,700 N-SEC	-31C, +51C	990 MM	
OFL 105F1	APFSDS-T	FR	520 MPa	TPA27X320EL84	18,000 N-SEC	-31C, +51C	987 MM	
OXT 105F1	TP-T	FR	200 MPa	TPA27X378ELF1	8,700 N-SEC	-31C, +51C	990 MM	Fire from F1 only. Safety template less than 6 km

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Round	Type	Country	Safe Max. Pressure	Primer Type	Recoil Impulse	Safety Temp. Range	Maximum Length	Remarks
GERMANY								
DM22	HEAT-MP-T	GE	427 MPa	DM72A2	15,600 N-SEC	-40C, +50C		
DM23A1	APFSDS-T	IS*/GE	427 MPa	DM32A1	13,200 N-SEC	-40C, +50C	885 MM	
DM23A2	APFSDS-T	IS*/GE	427 MPa	DM102	13,200 N-SEC	-40C, +50C		
DM33	APFSDS-T	IS*/GE	411 MPa	DM102A2	13,100 N-SEC	-40C, +50C	900 MM	
DM68	TP/HEAT-T	GE	505 MPa	DM72A2	15,600 N-SEC	-40C, +52C	999 MM	
DM128	TP/CSDS-T	GE	490 MPa	DM82A1	11,500 N-SEC	-40C, +52C	923 MM	
ITALY								
DM22	HEAT-MP-T	GE/IT	427 MPa	DM72A1/2	15,600 N-SEC	-40C, +50C	as GE Mod	Produced, but not in inventory
M456A2	HEAT-T-MP	US/IT	510 MPa	M83	18,200 N-SEC	-40C, +52C	991 MM	
M456	HEAT-T	US/IT	510 MPa	M83	18,200 N-SEC	-40C, +63C	991 MM	
M490	TP-T	US/IT	510 MPa	M83	18,200 N-SEC	-40C, +52C	940 MM	

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Round	Type	Country	Safe Max. Pressure	Primer Type	Recoil Impulse	Safety Temp. Range	Maximum Length	Remarks
ISRAEL								
<u>Made in Israël</u>								
M111	APFSDS-T	IS	510 MPa	L1A4		-40C, +52C	885 MM	
M80	APFSDS-T	IS	427 MPa	DM82		-40C, +50C	885 MM	
M85	APFSDS-T	IS	411 MPa	DM102		-40C, +50C	900 MM	
M87		IS		DM102				
M151	APFSDS-T	IS						
M156		IS						
M413	APFSDS-T	IS	4.50 Kp/cm ²	M427		-35C, +52C	990 MM	
11-152	HESH-T	IS						
11-154	APDS-T	IS						
11-156	HESH-T	IS						
11-161	TP-T	IS						
<u>Made under license from Israël</u>								
DM23A1 (M80)	APFSDS-T	IS*/GE	427 MPa	DM62A2	13,200 N-SEC	-40C, +50C	885 MM	

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Round	Type	Country	Safe Max. Pressure	Primer Type	Recoil Impulse	Safety Temp. Range	Maximum Length	Remarks
DM23A2	APFSDS-T	IS*/GE		DM102				
DM33	APFSDS-T	IS*/GE		DM102A2				
DM63	APFSDS-T	IS*/GE		M4512				
<u>SPAIN</u>								
PECA-T C512	APFSDS-T	SP	405 MPa	TPA27X318ELF1				
OCC 105F1	HEAT-T	FR/SP	350 MPa	TPA27x318ELF1	18,500 N-SEC	-32C, +52C	996 MM	
OE 105F1	HE	FR/SP	260 MPa	TPA27x318ELF1	12,200 N-SEC	-32C, +52C	990 MM	
OFUM 105F1	SMOKE-WP	FR/SP	270 MPa	TPA27x318ELF1	12,800 N-SEC	-32C, +52C	990 MM	
SCC 105F1	TP-T	FR/SP	350 MPa	TPA27x318ELF1	18,500 N-SEC	-32C, +52C	990 MM	
M 490	TP-T	US/SP	510 MPa	M83	18,200 N-SEC	-32C, +52C	940 MM	
M 456 A1	HEAT-T	US/SP	510 MPa	M83	18,200 N-SEC	-32C, +52C	991 MM	-32C, +30C if fired from F1 canon -32C, +30C if fired from F1 canon

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Round	Type	Country	Safe Max. Pressure	Primer Type	Recoil Impulse	Safety Temp. Range	Maximum Length	Remarks
UNITED KINGDOM	APDS-T	UK	510 MPa	L1A4	17,300 N-SEC	-46C, +52C	838 MM	Values are the same for all L28 variants
	HESH-T	UK	236 MPa	L1A4	11,200 N-SEC	-46C, +52C	940 MM	
	HESH-T	UK	236 MPa	L1A4	11,200 N-SEC	-46C, +52C	936 MM	
	HESH-T	UK	236 MPa	L4A1 or A2	11,200 N-SEC	-46C, +52C	940 MM	
	SH-TP-T	UK	236 MPa	L1A4	11,200 N-SEC	-46C, +52C	940 MM	L38A2 has same values
	SH-TP-T	UK	236 MPa	L1A4	11,200 N-SEC	-46C, +52C	940 MM	
	APDS-T	UK	510 MPa	L1A4	18,200 N-SEC	-46C, +52C	838 MM	Values are the same for all L52 variants
	APFSDS-T	UK	510 MPa	L20A1	18,300 N-SEC	-46C, +52C	948 MM	
	APFSDS-T	UK	510 MPa	L20A1	18,300 N-SEC	-46C, +52C	990 MM	
	DS/Prac-T	UK	510 MPa	L1A4	12,300 N-SEC	-46C, +52C	838 MM	

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Round	Type	Country	Safe Max. Pressure	Primer Type	Recoil Impulse	Safety Temp. Range	Maximum Length	Remarks
UNITED STATES								
M392	APDS-T	US	510 MPa	L4A1		-40C, +52C	838 MM	
M392A2	APDS-T	US	510 MPa	M80A1		-40C, +52C	838 MM	
M393A1	TP-T	US	510 MPa	M86		-40C, +52C	940 MM	
M393A1	HEP-T	US	510 MPa	M86		-40C, +52C	940 MM	
M393A2	HEP-T	US	510 MPa	M86		-40C, +52C	940 MM	
M416	SMOKE, WP-T	US	510 MPa	M86		-40C, +52C	940 MM	
M456	HEAT-T	US	510 MPa	M83	18,200 N-SEC	-40C, +60C	991 MM	
M456A1	HEAT-T	US	510 MPa	M83	18,200 N-SEC	-40C, +60C	991 MM	
M456A2	HEAT-T-MP	US	510 MPa	M83	18,200 N-SEC	-40C, +52C	991 MM	
M467	TP-T	US	510 MPa	M86		-40C, +52C	940 MM	Not in inventory
M490	TP-T	US	510 MPa	M83	18,200 N-SEC	-40C, +52C	940 MM	
M490A1	TP-T	US	510 MPa	M80A1		-40C, +52C	999 MM	
M494	APERS-T	US	510 MPa	M86		-40C, +52C	995 MM	Limited inventory
M724	TPDS-T	US	522 MPa	M80A1		-40C, +52C	838 MM	
M724A1	TPDS-T	US	522 MPa	M80A1		-40C, +52C	838 MM	
M728	APDS-T	US	522 MPa	M80A1		-54C, +52C	838 MM	
M735	APFSDS-T	US	522 MPa	M120		-32C, +52C	964 MM	
M774	APFSDS-T	US	522 MPa	M120		-37C, +52C	908 MM	
M833	APFSDS-T	US	522 MPa	M120	16,900 N-SEC	-37C, +52C	999 MM	
M900	APFSDS-T	US	597 MPa	M128	17,500 N-SEC	-29C, +49C	1004 MM	See notes 1,2,3

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AMMUNITION PARAMETERS

NOTES

Note 1: The M900 generates extremely high pressures (597 MPa) when fired at the upper firing temperature. This round has an equivalent full charge (EFC) value of 3.

Note 2: The M68A1 cannon, containing the M68A1 breech mechanism, is the only US system qualified to fire the M900 round.

Note 3: The M1 tank with a forged M68A1 breech is the only US tank safety certified to fire the M900 round.

Note 4: The impulse values listed for the French ammunition are valid for the F1 gun only. These values will be lower for the French rounds if fired from other 105 mm weapon systems.

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ANNEX D to
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PART 4 - AMMUNITION LISTED BY NATURES

ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
WAR-TYPE ROUNDS				
APDS-T types of rounds				
UK	DM13B1	GR	DM32	primer equivalent to L1A4
IS	M154	GR	L1A4	
UK	L28-series	DA L28A1	L1A4	out of stock from end-95
		DA L28A1B1	L1A4	out of stock from end-95
		IT L28-series	L1A4	
	L52A2	BE	L1A4	in BE inventory as L52A2B1
		DA	L1A4	out of stock from end-95
		IT	L1A4	
US	M728	US	M80A1	
APFSDS-T types of rounds				
CA	C76	CA	C18	
FR	OFL 105F1	FR	TPA27x320EL84	
IS/GE	(based on the IS development M111)	BE DM23A1	DM82A1	
		CA DM23A1	DM32A1	
		DA DM23	DM82	In DA inventory as model-type M/80
		DA DM23A2	DM102	
		GE DM23A1	DM32A1	
		DM23A2	DM102	
		GR DM23	DM28A1	

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ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
IS/GE (continued)	(based on the IS development M413)	DM23A1	DM32A1	
		GR DM23A2	DM102	Primer-type also DM82A1
		BE	DM102A2	
		DA	DM102A2	In DA inventory as model-type M/85
		GE	DM102A2	
		IT	DM102A2	
IS	M111/M151	NL	DM102A2	No longer operational
		CA	L1A4	
	M151	SP	L1A4	
		GR	L1A4	
		GR	M427	Primer equivalent to L1A4
SP	PECA-TC512	PO	M427	Primer equivalent to L1A4
		SP	TPA27x378ELF1	
UK	L64A4	NL	L1A4	No longer operational
	H6/62	-	L20A1	Not fielded by NATO countries
US	M735	GR	M120	
		US	M120	
	M774	US	M120	
	M833	US	M120	
	M900	US	M128	At UTF extreme high pressure (605 MPa). Effective full charge (EFC) value = 3. Only qualified for cannon M68A1 with forged breech M68A1.

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ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
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HEAT-T types of rounds

FR	OCC 105 F1	FR	TPA27x378ELF1	For cannon F1 only.
		SP	TPA27x378ELF1	For cannon F1 only
GE	DM 22 (with fuze M509A2)	GE	DM 72A2	
IS	M152	GR	M428	
US	M456-series (M456, M456E1, M456A1, M456A2, all with M509 Series fuzes)	GR M456A1	M83	
		M456A2	M83	MP-type of round
		IT M456A1	M83	
		M456A2	M83	(MP) Authorized use, but not in inventory
		PO M456A1	M83	
		SP M456A1	M509A2	
		US M456A1	M83	
		M456A2	M83	MP-type of round

HESH-T types of rounds

IS	M156	DA	L1A4	
		GR	L1A4	
NL	nr 108 (with fuze L56A1)	GR	nr 24	Primer nr 24 equivalent to L1A4
UK	L32A3 (with fuze ?)	-	L1A4	

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ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
	L35-series (A2: with fuze L29A2 A3: with fuze L56A1)	CA L35A2	L1A4	
		L35A3	L1A4	
		DA L35A3	L1A4	
		GR L35A2	L1A3	
		IT L35A2	L1A4	
		IT L35A3	L1A4	
	L37 (with fuze ?)	IT	L4A1 or L4A2	Authorized use, but not in inventory

HEP-T types of rounds				
US	M393-series (M393A1 with fuze M534 M393A2 with fuze M578)	BE	M393A2	M86
		GR	M393A2	M86
		IT	M393A2	M86
		PO	M393A2	M86
		US	M393A1	M86
			M393A2	M86

HE-T types of rounds				
FR	OE 105 F1 (with fuze FUI 56)	FR	TPA27x378ELF1	For cannon F1 only
		SP	TPA27x378ELF1	

APERS-T types of rounds				
US	M494 (with fuze M571)	US	M86	

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ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
SMOKE, WP-T types of rounds				
FR	OFUM 105 F1 (with fuze DP I 56)	FR	TPA27x378ELF1	
		SP	TPA27x378ELF1	
IS	M158	DA	L1A4	In DA inventory as model-type M/87
US	M416 (with fuze M534A1)	BE	M86	
		CA	M86	
		DA	M59	
		GR	M86	
		IT	M86	
		US	M86	
SMOKE, HC types of rounds				
UK	L39-series (with fuze NO.390 MK 3/1)	BE	L39A2	
		GR	L39A2	L2A2
			L39A3	L2A2 or L2A3
ILLUMINATING types of rounds				
FR	OECL 105 F1 (with fuze ???)	FR	TPA27X255EL69	

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ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
TRAINING-TYPE ROUNDS				
DS-T, Practice type of rounds (Training round for APDS-T types of rounds)				
CA	C74	CA	C16 or M80A1	
IS	M155	US	L1A4	
UK	L63A2	-	L1A4	Not in use by NATO countries
US	M724A1	BE	M80A1	
		GR	M80A1	
		US	M80A1	
FSDS-T or CSDS-T types of rounds (Training round for APFSDS-T types of rounds; fin or cone stabilized)				
CA	C71	CA	C16	Fin stabilized ; Max range < 8km (10° elevation)
		DA	C16	
GE	DM128	US	DM82A1	Limited use by the US
SH-T, Practice types of rounds (Training round for HESH-T types of rounds)				
CA	C72	CA	C15A2	
	C109	CA	C15A2	
DA	M87	DA	C15A2	
IS	M157	-	L1A4	Not in use in NATO
UK	L38-series	IT L38A2	L1A4	
		-	L1A4	Not in use by NATO countries
		IT	L1A4	

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ORIGINAL DEVELOPMENT	MODEL-TYPE ROUND	USER COUNTRY	MODEL-TYPE PRIMER	REMARKS
TP-T, types of rounds (<i>Training rounds for HEAT-T, HE-T and APERS-T types of rounds</i>)				
FR	BSCC 105 F1	FR	TPA27x378ELF1	FR indicated BSCC 105 F4 for round nomenclature; changed in F1 For cannon F1 only.
		SP	TPA27x378ELF1	For cannon F1 only
	OXT 105 F1	FR	TPA27x378ELF1	For cannon F1 only; max range < 6 km
IS	M161	GR	L1A4	
US	M393A1	US	M86	
	M467	GR	M81	
		US	M86	
	M490-series	GR M490	M83	
		IT M490	M83	
		SP M490	M83	
		US M490	M83	
		M490A1	M80A1	

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RATIFICATION AND IMPLEMENTATION DETAILSTADE DE RATIFICATION ET DE MISE EN APPLICATION

Nation		National Implementing Document national de mise en application	Implementation/Mise en application					
			Forecast Date prévue			Actual Date Date réelle		
			NAVY MER	ARMY TERRE	AIR	NAVY MER	ARMY TERRE	AIR
BE								
CA	MWA:2441-4458 (DLR3-4) of/du 12.12.95	This STANAG						12/95
DA	MA204.69-S4458/MAM3-20820 of/du 22.10.96	This STANAG						01/97
FR	1264 DEF/EMAT/ETUDES/20 of/du 20.05.97							05/97
GE	BMVg-FÜSIV2-Az03-51-60	This STANAG		05/98				
GR	FN.069.1/8/116612/DN.103/HAGS/DPPD/3 of/du 29.01.96							01/97
IT								
LU	BO 5943/95 of/du 04.10.95		WILL NOT IMPLEMENT/ NE MET PAS EN APPLICATION					
NL	NR M96000611 of/du 09.01.96		WILL NOT IMPLEMENT/ NE MET PAS EN APPLICATION					
NO	MAS-1092/96/FO/HST/JG/ST4458 of/du 02.12.96	This STANAG						01/97
PO								
SP	OMD No 323/11991/97 BOD No 195 (07-10-97) of/du 30.10.97							01/98
TU	TUDEL-97/260 of/du 20.01.97			12/99				
UK	D/DSTAN/341/8/4458 of/du 06.09.95							01/98
US	SAUS-IA-IPP of/du 26.05.97							01/98

* See overleaf reservations/Voir réserve au verso

+ See comments overleaf/Voir commentaires au verso

x Service(s) implementing/Armée(s) mettant en application

Releasable to NACC/PFP Non releasable /Peut être communiqué au CCNA/PPP Ne peut être communiqué